RESPONSE TO EG&G COMMENTS

ON THE PRELIMINARY DRAFT

SOIL VAPOR SURVEY WORK PLAN

ROCKY FLATS PLANT

903 PAD, MOUND, AND EAST TRENCHES AREAS

OPERABLE UNIT NO.2

U.S. Department of Energy
Rocky Flats Plant
Golden, Colorado

FEBRUARY 1993

List of commentors:

1. Craig Cowdery
2. Timothy Lovseth
3. Phil Ralphs
4. Mark Buddy, Iggy Liator, and Mark Bakeman
5. Dennis Schybbe
6. Paul Singh
7. Brook Wilson

Responses to Comments by:
Craig Cowdery

EG&G ROCKY FLATS
ENVIRONMENTAL MANAGEMENT DEPARTMENT

DOCUMENT REVIEW SHEET

PLEASE REVIEW THE ATTACHED DOCUMENT, NO. This does not have a document No. at this time REV. 0 DRAFT 1

TITLE Soil Vapor Survey Work Plan 903 Pad, Mound, and East Trenches dated 31 August 1992.

COMPLETE THE FOLLOWING AND RETURN THIS SHEET TO: CRAIG COWDERY BY ___/___/___

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SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (initial)
1.2, 1st Paragraph	The objectives need to be a little more specific. In particular, it needs to be made clear that the purpose of this survey is not to characterize OU 2 but only to provide guidance on placing the extraction wells. This could eliminate some of the comments suggesting a rigorous survey.	The section describing objectives will be revised to more clearly define the purpose of the survey and the use of the EPA Observational/Streamlined approach.	
1.2, 1st Paragraph	We need to avoid specifying a mobile laboratory, i.e. just specify a GC, although a mobile lab will probably be used	WESTON disagrees with this comment. In order to meet the specified Data Quality Objectives and follow the EPA Observational/Streamlined approach, the use of data from a mobile laboratory is required.	

NOTE: Comments listed on this review sheet were transcribed by WESTON from handwritten directly in a copy of the Preliminary Draft Soil Vapor Survey Work Plan dated 31 August 1992.

REVIEWER (PRINT): CRAIG COWDERY	PHONE	DATE	DEPT.
SIGNATURE OF REVIEWER:			
REVIEW TYPE: _INDEPENDENT __QA _X_PEER REVIEW __OTHER			

PROCEDURE NO. Soil Vapor Survey Work Plan 903 Pad, Mound, and East Trenches REV. 0

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (Initial)
Title Page	Add something to the title page about the subsurface	The title has been revised to relate the SVS Work Plan to the IM/IRAP/EA document.	
	IM/IRA to avoid confusion with the RI or previous		
	surveys		
Appendix A	Put in SOP for soil gas survey. Since a lot SOPs will	There are a number of soil gas sampling techniques that have evolved in recent years that will provide equivalent results. As long as the Data Quality Objectives are achieved it does not matter which technique is used. The work plan should not prevent qualified subcontractors from bidding on the work due to presentation of one technique or SOP. It is up to those firms bidding on the work to demonstrate that their proposed technique will meet the data quality objectives. The technique presented in the work plan is an example of the type of technique that can achieve the Data Quality Objectives, but certainly not the only technique available.	
	be applicable it would probably be best to list the		
	others as appropriate		
Table 3-1	Reduce data quantity as per recent discussions	The data quantity will be reduced using the 30 foot grid spacings, as specified in recent discussions with EG&G.	
Table 3-1	We need to introduce some consistency in the	The RFP Soil Gas Survey SOP presents procedures that are specific to a sampling technique. This contrasts to the approach used in the Work Plan to provide for contracting flexibility. For this reason, the SOP is intentionally not referenced in the Work Plan.	
	sampling approach It will be better for us on the		
	sampling if we reference our SOP and don't		
	over specify the methodology since this work plan		
	will be used directly for subcontracting the work		
Table 3-1	PARCC - Representativeness Do we need duplicates	The difference between duplicates and replicates has been clarified by expanding the discussion in Section 3.4.4.	
	and replicates. I'm not sure that I understand		
	what the difference is.		

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PROCEDURE NO. Soil Vapor Survey Work Plan 903 Pad, Mound, and East Trenches REV. 0

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (initial)
3.3.2	Discussions with our own laboratory personnel have indicated that the GC specified is overkill for our detection levels.	The equipment specified is only an example of the kind of equipment needed to meet the Data Quality Objectives. Other equipment and techniques may be substituted if they can meet the Data Quality Objectives. This will be clarified in the text.	
3.4.1	Where did the 48 hours come from? Is that standard?	Section 3.4.1 specifies that the portable laboratory will be mobilized prior to sampling and that the grid locations will be flagged. It states that this will occur approximately 48 hours prior to sampling. It is estimated that flagging the grid locations will be the most time consuming operation, but 48 hours is only an estimate.	
3.4	As has been discussed previously, it is alright to leave flexibility in the sampling procedure	The rationale for leaving flexibility in the sampling procedure will be clarified in the revised text.	
3.4.3	We need to make sure that the documentation follows existing procedures. We need to add something on sample identification, sample tracking, possibly something on RFEDS. We need a specific notation for each sample (Ask Mark Bogner, X8719)	The discussion on sample identification documentation will be clarified in the revised text.	
3.4.4, 1st 3 items	We really just need clean syringes and a GC capable of meeting our data quality objectives	The equipment listed is only an example of that available that would meet the Data Quality Objectives.	

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PROCEDURE NO. Soil Vapor Survey Work Plan 903 Pad, Mound, and East Trenches REV. _____

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (initial)
3.4.4	Where are these other procedures coming from? Are	These procedures do not come from GRAASP, but from previous soil gas programs. They are modified level II procedures designed to meet the specific needs of a soil gas program. The procedure of having written results for each days analyses being required by 10 a.m. on the following working day refers to the QA/QC procedures that need to be run each day to determine if the instrument is functioning properly. The reason for the 10 a.m. deadline is so that a days sampling is not conducted with a machine that wasn't functioning properly the day before.	
	these from GRAASP? These seem to be a little		
	more involved than level II calibration		
	procedures, could you recheck just to make sure.		
	We need to compare these to existing procedures.		
	I do not see a need for reporting the results by 10		
	a.m. It is probably a good idea if we get the results by		
	the end of the next day		
3.5 & 3.6	As was previously discussed we need more	These two sections will be expanded in detail in the revised text.	
	information written into these sections not about		
	procedures so much as about specifics. What kind		
	of waste where will it go what mechanisms		
	for waste handling and disposal? Where will		
	decon take place. Mostly information specific to		

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PROCEDURE NO. Soil Vapor Survey Work Plan 903 Pad, Mound, and East Trenches REV. ____

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (initial)
	this project that is not found in the procedures.		
Gen. Comments	I think that this report needs to emphasize the	An observational approach for determining whether additional soil gas samples will be pursued at a site, or whether the site will be abandoned for an alternative site has been incorporated into the Work Plan.	
	observational approach more. It also needs to		
	incorporate more of the existing procedures and		
	protocols		

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PROCEDURE NO. Soil Vapor Survey Work Plan 903 Pad, Mound, and East Trenches REV. ____

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (initial)
General	Note: This is not really a comment but a direction	WESTON proposes to substitute IHSS 110 as a primary site and IHSS 111.1 as a contingency site. Based upon available information there appears to be a greater likelihood in finding a source area at IHSS 110 than IHSS 111.1 for the Pilot Test.	
	Based on conversations between Eric Dille and myself		
	and the 9/25/92 meeting with Weston, it was		
	concluded that only IHSS's 112, 113, and 111.1		
	would be initially investigated with 30 foot centers		
	If nothing was found at the mound, rather than go		
	to 15 foot centers, a survey would be performed at		
	one of the two alternative sites. Additional		
	locations could be added as the survey proceeds		
	within the context of the observational approach.		

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Responses to Comments by:
Timmothy Lovseth

DOCUMENT REVIEW COMMENT RECORD

DOCUMENT REVIEWED: Soil Vapor Survey Work Plan, 903 Pad, Mound, and East Trenches Area, OU2

DOCUMENT REVIEWER: Timothy Lovseth SIGNATURE: Timothy Lovseth Date: 9/8/92

CITATION	COMMENT	DISPOSITION
1.2	✓The stated purpose is too vague. Should not the goal of this survey be to define the areal and vertical extent of VOCs in soil near the source areas?	The purpose of the Soil Vapor Survey (SVS) is to delineate the location of VOC source areas at the different sites, and to guide the placement of the vapor extraction wells for the Pilot Test. The SVS is not intended to define the areal and vertical extent of VOCs in the soil near the source area. As long as source areas are located then the vapor extraction well pilot tests will be successful.
Figures 1-1 and 1-2	Everything presented on Fig. 1-1 appears on Fig. 1-2. Only show one figure.	The two figures delineate between the individual IHSSs in remedial investigation areas versus those individual IHSSs that are soil vapor survey sites. Therefore, both figures are necessary for text clarity.
1.4 and Section 2	Criteria and rational for site sampling grid designs is not found in Section 2.	Based upon recent discussions with EG&G, the sampling grid spacing will be increased from 15 feet to 30 feet and the criteria and rationale will be based upon EPA Observational/Streamlining Methods and direct coordination with the EG&G Project Manager. The text will be revised accordingly.
Section 2 and Figs. 3-1 thru 3-5	Numerous references are made in Section 2 to soil borings and monitoring wells located near the proposed sampling grids, however, none of these borings or wells are shown on the corresponding reference maps.	References are made in the text to soil borings and monitoring wells located near the proposed sampling grids, but these locations are not shown on Figures 3-1 through 3-5. The figures will be revised to include these referenced locations.
Section 2	✓Phase I and Phase II RI data indicate VOCs in groundwater have migrated beyond the IHSS boundaries, yet all the proposed grids are configured within or at the perimeter of each IHSS. An increases of 20% in sampling density may not be adequate to define the extent of VOC contamination.	The SVS is not intended to define the areal and vertical extent of VOCs in the groundwater near each IHSS. The rationale and criteria for selecting additional sampling locations beyond the baseline grid will be based upon EPA Observational/Streamlining Methods and direct coordination with the EG&G Project Manager. The text will be revised accordingly.
3.2	✓The rational for estimating ten "deep" sampling locations is not clear. Are there no plans to address the interval between the deepest sampling point (10 ft. bgl) and the water table (up to	The SVS is not intended to define the vertical extent of VOCs in the soil near each IHSS. The rationale and criteria for selecting additional deep sampling locations beyond the baseline grid will be based upon EPA Observational/Streamlining Methods and direct coordination with the EG&G Project Manager. The text will be revised accordingly.

DOCUMENT REVIEWED: Soil Vapor Survey Work Plan, 903 Pad, Mound, and East Trenches Area, OU2

DOCUMENT REVIEWER: Timothy Lovseth SIGNATURE: Timothy Lovseth Date: 9/8/92

CITATION	COMMENT	DISPOSITION
3.2 cont'd	35 ft. bgl)? If this study is implemented as proposed, little information will be gathered regarding the vertical distribution of VOCs.	
Figure 3-1	Label the 903 pad.	The figure will be revised to label the 903 Pad.
3.3 and 3.4	An alternate method for sampling should be proposed in this work plan in the event soil probes can not be advanced to the required sampling depth. It is unlikely that the slam bar method will be any more successful as a means advancement given the coarse nature of the Rocky Flats Alluvium. Expect cobbles in excess of 6 inches in diameter at the proposed sampling sites.	The comment is acknowledged. Guidance is provided on page 3-13, paragraph 2, on procedures to be followed if hole refusal is encountered.
3.4.2	The work plan calls for moving to an undesignated location if boring refusal is met. The work plan should be specific as to how borehole clearing procedures will be followed to avoid unmarked buried hazards.	Boreholes will not be advanced in the SVS Program.

Responses to Comments by:
Phil Ralphs

EG&G ROCKY FLATS
ENVIRONMENTAL MANAGEMENT DEPARTMENT

DOCUMENT REVIEW SHEET

Page 1 of 4

PLEASE REVIEW THE ATTACHED DOCUMENT, NO. (The subject work plan needs a Document Number) REV. 0

TITLE Soil Vapor Survey Work Plan, 903 pad, Mound, and East Trenches Area (Operable Unit No. 2), Preliminary Draft

COMPLETE THE FOLLOWING AND RETURN THIS SHEET TO: Mack Brooks (QA Dept) BY 9/25/92

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SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (Initial)
General - Format	The general format of the work plan should adhere to that specified in EG&G/EM procedure 3-21000-ADM-05.03. Since this is not an RFI/RI work plan, the recommended Table of Contents is not applicable. However, the basic format including Title Page, page headers, approval block, etc. is applicable.	The text will be revised to adhere to EG&G formats for Title Page, page headers, approval block, etc.	
General - Document Number	A document number needs to be assigned to this work plan. A suggested document number is 21000-WP-OU02.06.	The suggested document number of 21000-WP-OU02.06, will be used for the document.	
General - Organization & Responsibilities	The organization for the work to be performed under this work plan needs to be established with an organization chart, and the responsibilities below the EG&G Project Manager need to be defined. The org. chart should illustrate lines of communications and interfaces between the EG&G Project Manager, other EG&G divisions, and subcontractors.	An organization chart will be prepared at the same time that project subcontractors are identified.	

REVIEWER (PRINT): Phil Rafalski	PHONE	DATE	DEPT
SIGNATURE OF REVIEWER: Phil Rafalski	779-7242	9/23/92	EM QA
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DOCUMENT NO. _____ REV. _____

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (Initial)
General - Sample Designation	Sections 3.4.3.1 and 3.2.3.2 require sample numbers to be recorded in field and laboratory logbooks. However, the work plan does not address sample designation (i.e., how are sample numbers assigned?). Sample identification requirements need to be addressed in the work plan.	The text will be revised to address sample identification requirements.	
General - Sample Handling	Requirements for containerizing, preserving, handling, and shipping (including maintaining the chain-of-custody of the samples such that the integrity of the samples can be verified) need to be addressed, as appropriate, in the work plan. If there are no requirements for sample preservation or shipment of samples (since analysis will be done on site), a statement of such should be included in the work plan.	Sample preservation or shipment of samples will not be required, since analysis will be done on site with a mobile laboratory.	
Table 3-1 (2nd page)	Under "Sampling and Analysis Approach" we suggest inserting into the first sentence that the total number of samples to be collected are "based on the use of a 15 foot sampling grid at each of the sampling grid locations described in Section 3.2." Also, the proposed analytical approach that will be used to meet the DQOs (i.e., field GC to generate analytical level II data) should be discussed here.	Suggested revisions to Table 3-1 will be made.	
Table 3-1 (2nd page)	Under 6.a) Precision - What is meant by "Replicate analysis ± 10% RFD?	RFD is a typographical error which should read RPD (relative percent deviation).	
Table 3-1 (2nd page)	Under 6.b) Accuracy - This is a quantitative (i.e., measurable) parameter, and as such, should have a defined objective. % recovery of an instrument to a known standard or matrix spike is used to determine accuracy. The last bullet on page 3-18 state	The range of ± 30% will be added to Table 3-1.	

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DOCUMENT NO. _____ REV. _____

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (Initial)
Table 3-1 (2nd page) (continued)	that daily recoveries must be within 70 - 130%. We suggest that this is the objective for accuracy, and that this range be added to Table 3-1.		
Table 3-1 (2nd page)	Under 6.c) Representativeness - This is a qualitative (i.e., non-measurable) parameter where the objective is to collect samples that represent actual conditions. This objective is met by developing and adhering to a sound sampling plan and adhering to accepted sampling, sample handling, and analytical procedures. Duplicates and replicates are quality control measures. We suggest moving the requirements of collecting field duplicates and replicates and replicate analysis to a bullet under Section 3.4.4.	Discussion of replicates and duplicates will be added to Table 3-1 and Section 3.4.4.	
Table 3-1 (2nd page)	Under 6.d) Completeness - Since all soil gas samples will be analyzed with a field GC, the objective for laboratory completeness of 95% is not applicable.	The use of a mobil laboratory should allow a completeness of 90-95% to be achieved. A completeness target of 90% will be assigned.	
Section 3.4, 1st paragraph	This paragraph must be revised. All RFP environmental restoration program work (including this SVS) must be conducted according to approved procedures. This can be accomplished by adhering to approved EG&G SOPs, and referencing those procedures in work plans, or developing new procedures and submitting them to EG&G, DOE, EPA, and CDH for review and approval. Therefore, the procedures described or referenced in the SVS Work Plan must be adhered to [i.e., they are not considered "examples"]. If changes to approved procedures are needed to complete the work, they must be submitted to EG&G for review	There are a number of soil gas sampling techniques and equipment that have evolved in recent years that will provide equivalent results. As long as the Data Quality Objectives are achieved it does not matter which technique is used. The work plan should not prevent qualified subcontractors from bidding on the work due to presentation of one technique. It is up to those firms bidding on the work to demonstrate that their proposed technique will meet the Data Quality Objectives. The techniques and equipment presented in the work plan are examples of the type of techniques and equipment that can achieve the Data Quality Objectives, but certainly not the only ones available.	

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DOCUMENT NO. _____ REV. _____

SECTION OR PARAGRAPH	COMMENT	DISPOSITION	Concur (Initial)
Section 3.4, 1st paragraph (continued)	and approval (Document Change Notices [DCNs] are used to make revisions to procedures). If alternative procedures are intended to be used, they must be submitted to EG&G for review and approval prior to initiating the work. If the SVS Work Plan is required to be approved by DOE, EPA, and CDH, then the use of any alternative procedures must also be approved by DOE, EPA, and CDH prior to beginning work. Substituting procedures that produce equivalent results is acceptable, provided that those who approved the original procedure concur that equivalent results will indeed be produced.		
Section 3.4.3.1	Location recorded in field logs and laboratory logs should consist of the location codes for the sampling grids (location codes are typically assigned by EG&G RFEDS personnel) and sample point within the grid.	Locations will be surveyed and flagged in the field by the SVS subcontractor. RFEDS location codes will not be required according to EG&G RFEDS personnel.	
Sections 3.5 and 3.6	These sections refer to an Appendix A. There is no Appendix A in the Work Plan, nor is such an appendix identified in the Table of Contents. What is Appendix A, when will it be included, and who is responsible for it? If Appendix A is intended to be the QAA for this work plan, to be developed by the QAPM, we should point out that it is the responsibility of those planning the work to describe or identify how (by procedure) the work will be accomplished. If QA were responsible for identifying applicable procedures, they may specify procedures that are not applicable to the work addressed in the work plan. Once a procedure is identified as being needed, it will be required whether it is applicable or not. Therefore, it is imperative that those planning the work identify how the work is to be done.	A Quality Assurance Addendum will be added as Appendices A.	

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REVIEW TYPE: ___ INDEPENDENT ___ QA ___ PEER REVIEW ___ OTHER	_____	_____	_____

Responses to Comments by:
Mark Buddy, Iggy Liator, and Mark Bakeman

NOTE TO THE READER:

The comments on the Soil Vapor Survey Work Plan that were provided by Mark Buddy, Iggy Liator, and Mark Bakeman were made directly into a copy of the draft document. Responses to each of these comments are included in this section. To assist the reader, the appropriate pages of the original document are also included after the responses.

Response to EG&G Comments on the Preliminary Draft Soil Vapor Survey Work Plan dated 31 August 1992

Commenters: Mark Buddy, Iggy Liator, and Mark Bakeman

Note: Handwritten comments were made directly in to a copy of the draft document. Responses to each of these comments are listed below.

1. General Comments - Section 3.4.2, page 3-13, line 11.

Response: There are a number of soil gas sampling techniques that have evolved in recent years that will provide equivalent results. As long as the Data Quality Objectives are achieved it does not matter which technique is used. The work plan should not prevent qualified subcontractors from bidding on the work due to presentation of one technique or SOP. It is up to those firms bidding on the work to demonstrate that their proposed technique will meet the data quality objectives. The technique presented in the work plan is an example of the type of technique that can achieve the Data Quality Objectives, but certainly not the only technique available.

2. General Comment - Sampling Depths.

Response: Sample depth may be limited by the presence of cobbles in the subsurface and cannot be specified exactly at each location. The purpose of the 3 to 5 foot depth is to take a shallow sample that is far enough below the land surface so that contaminants have not already volatilized to the atmosphere. The revised text will contain a discussion of the EPA Observational/Streamline approach that should address these concerns.

3. Section 1.1, page 1-1, paragraph 2.

Response: The purpose of the SVS is to select suitable locations for the VES System Pilot Test, not to be representative of all of the Eastern Trenches Area IHSSs. Based upon the information available IHSSs 111.1 and 110 are the best candidates for the VES System Pilot Test.

4. Section 1.2, page 1-4, 1st paragraph.

Response: Sample depth may be limited by the presence of cobbles in the subsurface and cannot be specified exactly at each location. The purpose of the 3 to 5 foot depth is to take a shallow sample that is far enough below the land surface so that contaminants have not already volatilized to the atmosphere. This rationale will be added to the revised text.

5. Section 1.4, page 1-5, 1st paragraph.

Response: Appendix A in the revised text will contain additional information not presented in the Draft document such as a Quality Assurance Addendum.

6. Section 2, pages 2-1 and 2-2. Text changes.

Response: Appropriate revisions will be made to the final text.

7. Table 3-1, page 3-2, 3-3 and discussion on 3-4.

Response: Soil vapor surveys are qualitative in nature, and are used to indicate potential contaminant sources but do not actually sample source media. Data quantity and additional sampling will be changed in the revised text based upon recent discussions with EG&G.

8. Section 3.2.1, page 3-10, 1st paragraph.

Response: The purpose of the SVS is not to characterize the IHSSs, but to find a suitable location for the VES Pilot Test. There is a higher likelihood of finding contaminants in the stained areas than the unstained areas.

9. Section 3.3.1, page 3-11, paragraph 4.

Response: There are a number of soil gas sampling techniques using different equipment, that have evolved in recent years that will provide equivalent results. As long as the Data Quality Objectives are achieved it does not matter which technique is used. The work plan should not prevent qualified subcontractors from bidding on the work due to presentation of one technique, piece of equipment or SOP. It is up to those firms bidding on the work to demonstrate that their proposed technique will meet the Data Quality Objectives. The techniques and equipment presented in the work plan are an example of the type of technique that can achieve the Data Quality Objectives, but certainly not the only technique or equipment available.

10. Section 3.4.1, page 3-13, paragraph 1.

Response: The first sentence states that "The portable laboratory will be mobilized to the site with all necessary equipment, instrumentation, and manpower approximately 48 hours prior to the beginning of the sampling program." The suggested addition to the end of this paragraph is redundant and will not be included.

11. Section 3.4.3.1, page 3-15, paragraph 3.

Response: The evacuation time before sampling would include syringe evacuation. This will be clarified in the text revision.

12. Section 4.1, page 4-1, 1st paragraph.

Response: The EG&G Project Manager will make final decisions regarding additional Phase II sampling points. This will be clarified in the text revision.

3.4.1 Pre-Field Sampling Tasks

The portable laboratory will be mobilized to the site with all necessary equipment, instrumentation, and manpower approximately 48 hours prior to the beginning of the sampling program. The laboratory will be set up, and the instrumentation powered up, allowed to stabilize, and then calibrated prior to soil gas analysis the sampling. During this period, the planned grid locations for Phase I soil gas collection points will be flagged. Sampling will not begin until the portable lab is fully operational!

3.4.2 Field Sampling Procedures

Shallow sampling to depths of 3 to 5 feet will be accomplished by driving a soil probe into the ground using a truck-mounted or portable driver or equivalent. In order to penetrate asphalt (present a IHSS No. 112) it may be necessary to first punch a hole with a hydraulic hammer before driving the probe. If hole refusal is encountered, it may be necessary to drive a preliminary hole into the soil with a "slam bar", and then insert a soil probe into the hole. The diameter of the slam bar should be less than the soil probe to ensure a tight seal. If refusal is met using the "slam bar", a second and third attempt will be made within 3 feet of the original location before moving to the next pre-designated sampling location. After the soil probe has been driven, the probe will be lifted a few inches allowing the drive tip to drop, and gas to enter the probe. Teflon tubing will be attached to the top of the soil probe. A Teflon septum (or a gas sampling bulb, depending on the sampling method used) will be attached to the Teflon tubing and a vacuum gauge, flow meter, and flow control valve will be installed will be downstream of the septum. The vacuum pump will be turned on and used to evacuate at least 3 probe volumes of air using the measured flow rate to calculate the required evacuation time. With the vacuum pump running, a gas tight syringe is inserted through the septum (Figure 3-6). The syringe will be purged several times with soil gas after which a soil gas sample will be collected. The syringe will then be removed from the septum, the end of the needle plugged, and the sample delivered to the mobile laboratory for analysis.

The vacuum pump will then be turned off and the probe removed from the ground using a hydraulic puller mechanism on the probe driver. The used probe will be stored separately from

please provide rationale for ½ depth

The SVS Program involves collection and analysis of soil gas from 3 to 5 feet below the ground surface. Soil gas samples will be analyzed in a mobile laboratory unit with a gas chromatograph. The analytical results will be used to map the occurrence of VOCs in the soil gas and to assist in the identification of source areas.

The SVS is an effective way to map subsurface VOCs. VOCs readily partition out of the unsaturated and saturated zones and into the soil gas. The VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. Typically, a concentration gradient develops between the source area and the ground surface. Thus, high VOC vapor levels at or near the ground surface may be indicative of a local source area.

1.3 SCOPE

SVS sample location grids have been established at five sites based on previously collected Phase I RI data (EG&G, 1987) and preliminary Phase II RI data. Three of the sites include the proposed subsurface IM/IRA VES test sites. SVS sample location grids for a fourth site located in the East Trenches Area and a fifth site located in the 903 Pad Area have also been developed. These latter two sites also contain suspected VOC source areas. The SVS includes three primary tasks, each of which are described in detail in Sections 3 and 4 of this Work Plan.

- Identification of field sampling locations (i.e., sampling grids).
- Soil vapor sampling and analysis.
- Evaluation of analytical results and reporting.

1.4 WORK PLAN ORGANIZATION

Section 2 of this Work Plan describes each of the locations to be surveyed and the criteria and rationale for the site sampling grid designs. Section 3 presents the SVS Program including field sampling procedures and analytical methods to be used to perform the SVS for each of the three sites. Section 4 presents the methods to be used to evaluate and report the data collected during

SECTION 1
INTRODUCTION

1.1 BACKGROUND

The final Proposed Subsurface Interim Measures/Interim Remedial Action Plan/Environmental Assessment (IM/IRAP/EA; EG&G, 1992a) addresses removal of residual free-phase volatile organic compound (VOC) contamination suspected in the subsurface within an area identified as Operable Unit No. 2 (OU2) (Figure 1-1). The term "residual" free-phase refers to the non-aqueous phase contamination remaining in the soil matrix (by capillary force) subsequent to the passage of dense non-aqueous-phase liquid (DNAPL) through the subsurface. The proposed free-phase VOC-removal actions involve pilot testing *in situ* vacuum-enhanced vapor extraction at three different hydrogeologic settings at OU2. The unique hydrogeologic settings exist at the 903 Pad Area, Mound Area and East Trenches Area.

As discussed in the subsurface IM/IRAP/EA, the precise locations for installation of the vapor extraction systems (VES) will be determined from the Phase II Remedial Investigation (RI) data and results of soil vapor surveys (SVS) to be conducted pursuant to this work plan. Individual Hazardous Substance Sites (IHSS) 111.1, 112, and 113 (Figure 1-2) have been preliminarily targeted for the VES testing because of the likely presence of free-phase VOCs. The SVSs will focus on these three IHSSs, as well as two other IHSSs (Nos. 109 and 110) suspected to be source areas for VOC contamination, in order to optimize the locations for the VES extraction wells. The IHSS's in the eastern part of the trench area (111.3-5,216.2-3) aren't included in SVS. Will IHSS's 110 and 111.1 be representative of this area?

1.2 PURPOSE

The purpose of the SVS is to provide information on the location of residual free-phase VOCs in the subsurface. This information will be used to delineate the location of VOC source areas at each of the three sites, if present, and to guide the placement of the vapor extraction wells.

please provide rationale for

The SVS Program involves collection and analysis of soil gas from 3 to 5 feet below the ground surface. Soil gas samples will be analyzed in a mobile laboratory unit with a gas chromatograph. The analytical results will be used to map the occurrence of VOCs in the soil gas and to assist in the identification of source areas.

The SVS is an effective way to map subsurface VOCs. VOCs readily partition out of the unsaturated and saturated zones and into the soil gas. The VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. Typically, a concentration gradient develops between the source area and the ground surface. Thus, high VOC vapor levels at or near the ground surface may be indicative of a local source area.

1.3 SCOPE

SVS sample location grids have been established at five sites based on previously collected Phase I RI data (EG&G, 1987) and preliminary Phase II RI data. Three of the sites include the proposed subsurface IM/IRA VES test sites. SVS sample location grids for a fourth site located in the East Trenches Area and a fifth site located in the 903 Pad Area have also been developed. These latter two sites also contain suspected VOC source areas. The SVS includes three primary tasks, each of which are described in detail in Sections 3 and 4 of this Work Plan.

- Identification of field sampling locations (i.e., sampling grids).
- Soil vapor sampling and analysis.
- Evaluation of analytical results and reporting.

1.4 WORK PLAN ORGANIZATION

Section 2 of this Work Plan describes each of the locations to be surveyed and the criteria and rationale for the site sampling grid designs. Section 3 presents the SVS Program including field sampling procedures and analytical methods to be used to perform the SVS for each of the three sites. Section 4 presents the methods to be used to evaluate and report the data collected during

implementation of the SVS program. Appendix A presents applicable Rocky Flats Plant Standard Operating Procedures for decontamination and management of investigation-derived waste.

Need SOP for soil gas

SECTION 2
SITE DESCRIPTION

OU2 is defined in the Federal Facility Agreement and Consent Order (FFACO), otherwise known as the Inter-Agency Agreement [IAG]) (DOE,1991) as an area comprised of 20 IHSS that are known in aggregate as the 903 Pad, Mound, and East Trenches Areas. These areas are located east-southeast of the RFP (Figures 1-1 and 1-2), ~~The areas of OU2 lie within either the~~ Woman Creek ~~or~~ South Walnut Creek drainage basins. A general description of each of five IHSS in three areas, including past and present use, hydrogeology, and contaminant type and distribution is presented in the following sections.

2.1 903 PAD Area(IHSS No. 112)

IHSS No. 112, the former drum storage area at the 903 Pad, experienced a reported release of 5,000 gallons of fluid including hydrocarbon oils, carbon tetrachloride, hydraulic oils, vacuum pump oils, trichloroethylene (TCE) and tetrachloroethylene (PCE) (EG&G, 1992a). Carbon tetrachloride has been detected in ground water downgradient of the 903 Pad. The suspected locations of fluids released at 903 Pad were determined by review of aerial photographs which reveal the former location of storage drums and areas of stained soils.

Section 4.3.1.2 of the IM/IRAP/EA presents an idealized conceptual hydrogeologic and contaminant distribution model for IHSS 112 (EG&G, 1992a), based on results of Phase I and II RI data. The data indicate that sand and gravel may extend to approximately 18 feet below ground surface in the vicinity of the 903 Pad Area, and that the alluvium may contain unconfined ground water perched on bedrock with a saturated thickness of approximately 4 feet. This thickness may vary seasonally. The alluvium overlies claystone bedrock that may contain isolated or interconnected fractures (EG&G, 1990).

It is expected that carbon tetrachloride comprises the majority of the released contaminants at IHSS 112 with lesser amounts of TCE and PCE. The conceptual model indicates that these DNAPLs may migrate through the vadose zone and the saturated alluvium, coming to rest in

east and south to the 903 Pad

Two soils were excavated, and described and analyzed. The sand and gravel extend to a depth of 16 cm (refill). Next we found Bt, Bmk and Bk horizons with texture that varies between sandy clay to sandy clay loam. The depth of the trenches did not exceed 105 cm (~ 4 feet)

structural depressions on the claystone bedrock surface. The DNAPL may also infiltrate bedrock fractures. Results of ground-water monitoring were inconclusive with respect to the presence of dissolved or free-phase chlorinated solvents in the bedrock. expand

2.2 903 PAD AREA (IHSS No. 109)

It is believed that IHSS No. 109 (Trench T-2) was used from approximately 1969 to 1971 for the disposal of nonradioactive liquid wastes. After radiation screening, solvents which were found to be nonradioactive were disposed into the trench. The solvents were disposed in small quantities and may have included PCE, TCE, carbon tetrachloride, paint thinner and small quantities of construction related chemicals.

The log of a boring (No. 7391) advanced as part of the Phase II RI 60 feet south of the trench was examined. The geology consists of unsaturated, clayey and sandy gravel over claystone bedrock which was encountered at 8.1 feet. Phase II RI analytical data is currently not available, however, a review of soil chemistry data presented in the Phase I RI (Rockwell, 1987) revealed the presence of 16 mg/kg of TCE in soils directly adjacent to Trench T-2. In addition, a TCE isoconcentration contour map presented in the IRAP (EG&G, 1992) shows a dissolved TCE groundwater plume apparently originating in the area around this trench. The presence of soil and ground water contamination in this area coupled with a history of solvent disposal suggests Trench T-2 as a source area for TCE contamination in this portion of the 903 Pad Area.

2.3 MOUND AREA (IHSS No. 113)

IHSS No. 113 was used to store an estimated 1,405 drums containing primarily depleted uranium and beryllium contaminated lathe coolant (a mixture of hydraulic oil and carbon tetrachloride). Some drums were reported to contain PCE. Ground-water samples collected downgradient of the Mound Area contained PCE, indicating that leakage from these drums may have occurred. Soil contamination at the Mound Area (IHSS No. 113) is expected to be limited to PCE and carbon tetrachloride.

Table 3-1

Soil Vapor Survey Program
Data Quality Objectives

why consider qualitative?

1. DATA USES/USERS:

Soil gas samples will be analyzed in an on-site mobile laboratory to provide qualitative data on VOCs in the unsaturated zone at each of five locations within OU2. Data will be used by the EG&G Project Manager to locate potential liquid VOC source areas. These data will be used to locate the vapor extraction wells.

2. DATA TYPES

- Systematic grab samples of soil gas along an established grid.

3. DATA QUALITY

a) Prioritized data uses:
   - Site characterization

b) Appropriate analytical level
   - Level II - mobile laboratory GC

c) Contaminants of concern
   - Carbon tetrachloride, TCE, and PCE

d) Required detection limit
   - 2 ppmV per contaminant of concern

4. DATA QUANTITY

- Initial grid on site, 406 samples (194 for IHSS 112, 104 for IHSS 113, 42 for IHSS 111.1, 42 for IHSS 110, and 24 IHSS 109).
- 20% additional samples to expand grid off-site or increase grid density on-site, depending on results from initial 20 samples.
- Approximately 10 deeper samples.

Table 3-1 (Continued)

Soil Vapor Survey Program
Data Quality Objectives

5. SAMPLING AND ANALYSIS APPROACH

A total of 485 samples of soil gas will be collected by inserting soil probes to a depth of 3 to 5 feet. A 125 milliliter sample will be collected in a glass bulb and analyzed for VOCs within 24 hours. Approximately 10 deeper samples will also be taken.

6. PARCC PARAMETERS

a) Precision
- Field replicates ± 20% RPD
- Replicate analysis ± 10% RFD

b) Accuracy
- Use of calibration standards in laboratory provides accuracy.
- Analysis once per day of an independently prepared gas standard.

c) Representativeness
- Field duplicates 5% (within 2 feet of original sample location).
- Field replicates 10%.
- Replicate analysis 10%.

d) Completeness
- Laboratory completeness 95%
- Field completeness 90%

e) Comparability
- Soil gas VOC concentration data is qualitative and provide identification and relative concentration levels of VOCs in soil.

RPD - relative percent deviation

interval (Figures 3-1 to 3-5). A typical SVS sampling interval is 25 to 50 feet depending upon site geology (Devitt et al., 1987; Chambers and Hennier, 1991; Joyner and Thomsen, 1991; Nielsen, 1991). However, since the suspected contaminant sources are known and the purpose of the SVS is to optimize the location of soil vapor extraction wells, a smaller interval has been chosen. The grid points are placed in staggered rows to provide a triangular grid pattern, which has been demonstrated through statistical analysis to provide more complete coverage.

In the second phase of the SVS program, sampling intervals will be reduced at zones with highest concentrations by the use of additional sampling points to further define potential contaminant source areas. Depending upon the source configuration, deeper samples may be required (at the direction of EG&G personnel) in certain locations. For example, the surface soils at the Mound Area IHSS No. 113 have been disturbed. There is evidence of a release due to high concentrations of dissolved contaminants found in a nearby well (No. 0174) (EG&G, 1992). A deeper soil gas sample taken at the same elevation as the screened interval (10 feet below ground) might detect contaminants not present in the surface soils.

An estimated total of 406 sampling points will be required to obtain a 15 foot grid spacing for the Phase I baseline sampling at the five sites. It is estimated that 42 points will be required for IHSS No. 111.1; 104 points for IHSS No. 113; 194 points for IHSS No. 112; 24 points for IHSS No 109; and 42 points for IHSS No. 110. For Phase II sampling, a number of sampling points equal to 20% of the Phase I sampling points will be made available to better characterize potential contaminant source areas. It is estimated that 10 deep sampling points (up to 10 feet in depth) may be required if shallow samples contain no contaminants.

3.2.1 903 Pad Area (IHSS No. 112)

The 903 Pad covers an area of approximately 395 feet by 370 feet (Figure 3-1). Aerial photographs of the 903 Pad taken on 29 April 1967, 10 April 1968, and 24 May 1969 (DOE, 1992a) indicate areas of soil staining. The SVS will concentrate on these stained areas (Figure 3-1) because they are anticipated to produce higher levels of soil gas VOCs as compared to unstained areas. A grid consisting of 194 sample points has been designed to cover these

stained areas. The largest stained area in the center of the site will be covered by 76 sample grid points. The small stained areas to the west may be covered by 12 points. The large stained area to the east will require 37 points with surrounding smaller areas requiring an additional 11 points. The remaining 58 points will be used to address the southern area. A grid spacing of 15 feet will be utilized initially and may be augmented, at the direction of EG&G personnel, with up to 39 additional sampling points based on the soil gas analytical results from the Phase I survey.

~> This scheme assumes no VOC's in unstained areas. I agree in intensive sampling of stained areas. If unstained areas are contaminated, will this make a difference in placement of vapor extraction wells? If it doesn't make a difference, then unstained areas not a concern.

3.2.2 903 Pad Area (IHSS No. 109)

IHSS 109 is approximately 70 feet long and 3 feet wide (Figure 3-4). Soil vapor sample points will be placed directly on either side of the trench. A total of 24 points will be used with a spacing of 15 feet. This grid may be augmented, at the direction of EG&G personnel, with up to 5 additional sampling points to further define contaminated areas.

3.2.3 Mound Area (IHSS No. 113)

The Mound Site (IHSS No. 113) covers an area approximately 200 by 120 feet (Figure 3-2). A total of 104 sample points will cover the entire area of IHSS No. 113 at 15 foot spacing. The grid spacing may be augmented, at the direction of EG&G personnel, with up to 21 additional sampling points based upon Phase I SVS analytical results. Of these, up to 10 sampling points may be deep (10 foot depth).

3.2.4 East Trenches Area (IHSS No. 111.1)

IHSS No. 111.1 is approximately 300 feet long and 3 feet wide (Figure 3-3). Soil vapor sample points will be placed directly on either side of the trench. A total of 42 sample points will be used to surround the perimeter of the trench; therefore, at a 15 foot spacing interval, 20 sample points will be placed down each side of the trench and 1 sample point will be placed at each end.

The grid spacing may be augmented, at the direction of EG&G personnel, with up to 8 additional sampling points based upon Phase I SVS results.

3.2.5 East Trenches Area (IHSS No.110)

IHSS 110 is approximately 300 feet long and 3 feet wide (Figure 3-5). Soil vapor sample points will be placed directly on either side of the trench with a spacing of 15 feet. A total of 42 points will be used with a spacing of 15 feet. This grid may be augmented, at the direction of EG&G personnel, with up to 8 additional sampling points to further define contaminated areas.

3.3 EQUIPMENT

This subsection provides a list of the basic field and analytical equipment used to conduct the SVS. This list is intended to provide examples of the types of equipment that may be required and, as such, may not be a comprehensive equipment list. The actual equipment used will depend on the exact SVS methods employed. It is required, however, that the SVS methods and equipment used meet the SVS program DQOs set forth in Section 3.1.

3.3.1 Sampling Equipment

- Portable or truck-mounted driver for soil probes.
- Slam bar to prime hole (if soil probe refusal is met).
- Soil probe.
- Drive tips.
- Teflon tubing.
- Assembly to connect Teflon tubing to soil probe.
- Teflon septa.
- Vapor sampling pump.
- Vacuum gauge sized for pump operating range.

Gt 9.0 is the SOP for Soil gas ~~and~~ sampling

does 3.3.1 list and Gt. 9.0 agree?

3.4.1 Pre-Field Sampling Tasks

The portable laboratory will be mobilized to the site with all necessary equipment, instrumentation, and manpower approximately 48 hours prior to the beginning of the sampling program. The laboratory will be set up, and the instrumentation powered up, allowed to stabilize, and then calibrated prior to soil gas analysis the sampling. During this period, the planned grid locations for Phase I soil gas collection points will be flagged. Sampling will not begin until the portable lab is fully operational!

3.4.2 Field Sampling Procedures

Shallow sampling to depths of 3 to 5 feet will be accomplished by driving a soil probe into the ground using a truck-mounted or portable driver or equivalent. In order to penetrate asphalt (present a IHSS No. 112) it may be necessary to first punch a hole with a hydraulic hammer before driving the probe. If hole refusal is encountered, it may be necessary to drive a preliminary hole into the soil with a "slam bar", and then insert a soil probe into the hole. The diameter of the slam bar should be less than the soil probe to ensure a tight seal. If refusal is met using the "slam bar", a second and third attempt will be made within 3 feet of the original location before moving to the next pre-designated sampling location. After the soil probe has been driven, the probe will be lifted a few inches allowing the drive tip to drop, and gas to enter the probe. Teflon tubing will be attached to the top of the soil probe. A Teflon septum (or a gas sampling bulb, depending on the sampling method used) will be attached to the Teflon tubing and a vacuum gauge, flow meter, and flow control valve will be installed will be downstream of the septum. The vacuum pump will be turned on and used to evacuate at least 3 probe volumes of air using the measured flow rate to calculate the required evacuation time. With the vacuum pump running, a gas tight syringe is inserted through the septum (Figure 3-6). The syringe will be purged several times with soil gas after which a soil gas sample will be collected. The syringe will then be removed from the septum, the end of the needle plugged, and the sample delivered to the mobile laboratory for analysis.

The vacuum pump will then be turned off and the probe removed from the ground using a hydraulic puller mechanism on the probe driver. The used probe will be stored separately from

Will infiltration of soil gas be a concern?

Responses to Comments by:
Paul Singh

NOTE TO THE READER:

The comments on the Soil Vapor Survey Work Plan that were provided by Paul Singh were made directly into a copy of the draft document. Responses to each of these comments are included in this section. To assist the reader, the appropriate pages of the original document are also included after the responses.

the clean probes, for later decontamination. The probe holes will be backfilled with a thin bentonite slurry to the extent practical. A requirement for work conducted at IHSS No. 112 (903 PAD) includes installing a surface seal compatible with and equal in thickness to the existing asphalt cap.

3.4.3 Documentation

A laboratory log notebook and a field log notebook will be maintained during the time that sampling and analyses are conducted. A copy of the log notebooks will be provided to EG&G after the completion of the project.

3.4.3.1 Contents of Field Log Notebook

The field log notebook will include, but not be limited to, the following information:

- Time (military notation).
- Sample number.
- Location (approximated description).
- Sampling depth.
- Evacuation time before sampling.
- Inches of mercury on vacuum pump gauge.
- Probe and adaptor identification numbers.
- Observations (i.e., ground conditions, paving type, soil appearance, surface water, odors, vegetation, etc.)
- Back-fill procedure and materials.
- Sample location marked on site map.

SECTION 4
DATA REPORTING AND ANALYSIS

4.1 DATA EVALUATION IN THE FIELD

The use of the mobile laboratory will allow collection of real-time analytical results (i.e., within 1 hour after the sample is taken). The Phase I grid sampling locations are based upon 15 foot intervals. If the analytical data generated during the Phase I soil vapor survey and prescreening of purged discharges indicates the presence of high levels of contaminants in certain locations, this information will be used to locate additional Phase II sampling points to better define the configurations of the contaminant source areas. Deeper samples may be taken, if the real-time analytical data indicates that no concentrations of VOCs are present, but it is suspected that there may be a residual pool of DNAPLs at the bedrock contact. This is most likely to occur at Mound where the saturated thickness of the aquifer is small or even seasonally dry.

4.2 DATA REPORTING REQUIREMENTS

The final project report will include each of the following elements for the SVS conducted at each site:

- Soil vapor VOC concentration and depth data.
- Quality Assurance/Quality Control results.
- Maps of sample locations.
- VOC isoconcentration maps.
- Discussion and data interpretation.
- Recommendations for location of the Pilot VES injection and extraction wells at each site.

How the spatial configuration of the soil report will be determined?

EG&G rep should be involved in data evaluation before additional holes will be located and drilled!

Responses to Comments by:
Dennis Schybbe

NOTE TO THE READER:

The comments on the Soil Vapor Survey Work Plan that were provided by Dennis Schybbe were made directly into a copy of the draft document. Responses to each of these comments are included in this section. To assist the reader, the appropriate pages of the original document are also included after the responses.

TABLE OF CONTENTS

Indent

Trichloroethylene (TCE) is expected to be the primary contaminant at this site. A sample of water collected in May 1988 from monitoring well 3687 contained 221.8 milligrams per liter (mg/l), which represents 20 percent of the TCE solubility limit. This well is screened in the sandstone bedrock. The high concentration of TCE within 40 feet of IHSS No. 111.1 suggests the presence of residual free-phase TCE in the soils and aquifer underlying this burial trench. The conceptual model indicates that DNAPL has migrated downward through the unsaturated alluvium and sandstone leaving a zone of residual free-phase solvent. The solvent may have migrated downward through the saturated zone and come to rest in structural depressions on the underlying claystone and migrated a short distance through the fractures in the claystone.

2.5 EAST TRENCHES AREA (IHSS No. 110)

IHSS No. 110 (Trench T-3) was used primarily for the disposal of sanitary wastewater treatment plant sludge. The sludge disposed in the trench typically consisted of concentrated organic matter found in sanitary wastewater treatment plant sludge. Uranium contamination may also be present as a result of contaminated, flattened drums that may have been disposed in the trench. The exact dates of operation of this trench are unknown. It is known, however, that disposal operations at Trench T-3 were conducted during the period of July 2, 1955 through August 14, 1968.

Site specific geologic, hydrogeologic, and contaminant type and distribution information for IHSS 110 is not currently available. The log of a shallow borehole (No. 2791) advanced as part of the Phase II RI 50 feet north of the east end of the trench was examined. The geology consisted of 12.9 feet of unsaturated, sandy gravel alluvium over a sandy/clayey siltstone bedrock. There is also a log available for a bedrock well (No. 12191) 15 feet south of the east side of the trench. The geology consisted of 15 feet of unsaturated, sandy gravel alluvium over silty sandstone to 27.5 feet where groundwater is first encountered. Next is a layer of sandstone between 27.5 feet and 35 feet underlain by clayey sandstone. The total depth of the well was 37 feet.

Preliminary chemical data on soil samples collected as part of the Phase II RI revealed the presence of several chlorinated solvents. A soil sample collected at 3 feet below ground surface during the advancement of a boring (No. 10191) through the west end of Trench T-3 contained PCE at 1,300 mg/kg and lesser amounts of TCE, carbon tetrachloride and chloroform. Contaminant concentrations were found to decrease rapidly with depth in this boring. The high concentration of PCE in the soil suggests that DNAPL has migrated downward through the unsaturated alluvium and sandstone leaving some residual in this material.

(_mg/kg per_ft)?

Table 3-1

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1. DATA USES/USERS:

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2. DATA TYPES

- Systematic grab samples of soil gas along an established grid.

3. DATA QUALITY

a) Prioritized data uses:
   - Site characterization — can level II data be utilized for characterization or will data support further characterization or RI?

b) Appropriate analytical level
   - Level II - mobile laboratory GC

c) Contaminants of concern
   - Carbon tetrachloride, TCE, and PCE

d) Required detection limit
   - 2 ppmV per contaminant of concern ?

4. DATA QUANTITY

- Initial grid on site, 406 samples (194 for IHSS 112, 104 for IHSS 113, 42 for IHSS 111.1, 42 for IHSS 110, and 24 IHSS 109).
- 20% additional samples to expand grid off-site or increase grid density on-site, depending on results from initial 20 samples.
- Approximately 10 deeper samples. What does this mean? deeper than what?

Table 3-1 (Continued)

Soil Vapor Survey Program
Data Quality Objectives

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define

6. PARCC PARAMETERS

a) Precision
- Field replicates ± 20% RPD
- Replicate analysis ± 10% RFD

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- Use of calibration standards in laboratory provides accuracy.
- Analysis once per day of an independently prepared gas standard.

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- Field duplicates 5% (within 2 feet of original sample location).
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- Laboratory completeness 95%
- Field completeness 90%

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- Soil gas VOC concentration data is qualitative and provide identification and relative concentration levels of VOCs in soil.

RPD - relative percent deviation

interval (Figures 3-1 to 3-5). A typical SVS sampling interval is 25 to 50 feet depending upon site geology (Devitt et al., 1987; Chambers and Hennier, 1991; Joyner and Thomsen, 1991; Nielsen, 1991). However, since the suspected contaminant sources are known and the purpose of the SVS is to optimize the location of soil vapor extraction wells, a smaller interval has been chosen. The grid points are placed in staggered rows to provide a triangular grid pattern, which has been demonstrated through statistical analysis to provide more complete coverage.

In the second phase of the SVS program, sampling intervals will be reduced at zones with highest concentrations by the use of additional sampling points to further define potentgridial contaminant source areas. Depending upon the source configuration, deeper samples may be required (at the direction of EG&G personnel) in certain locations. For example, the surface soils at the Mound Area IHSS No. 113 have been disturbed. There is evidence of a release due to high concentrations of dissolved contaminants found in a nearby well (No. 0174) (EG&G, 1992). A deeper soil gas sample taken at the same elevation as the screened interval (10 feet below ground) might detect contaminants not present in the surface soils.

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Commenter: Paul Singh

Note: Handwritten comments were made directly into a copy of the draft document. Responses to each of these comments are presented below.

1. Section 1.2, page 1-4, paragraph 2.

Response: VOCs will volatilize into soil gas from the saturated zone as a function of their Henry's Law Constant.

2. Section 2.4, page 2-4.

Response: Well or boring locations mentioned in the text will be shown on the revised figures.

3. Table 3-1, page 3-2 to 3-3.

Response: The detection limit has been changed to 20 ppbV.

There are a number of soil gas sampling techniques using different equipment, that have evolved in recent years that will provide equivalent results. As long as the Data Quality Objectives are achieved it does not matter which technique is used. The work plan should not prevent qualified subcontractors from bidding on the work due to presentation of one technique, piece of equipment or SOP. It is up to those firms bidding on the work to demonstrate that their proposed technique will meet the Data Quality Objectives. The techniques and equipment presented in the work plan are an example of the type of technique that can achieve the Data Quality Objectives, but certainly not the only technique or equipment available.

Soil gas sampling should not be conducted immediately after a rainfall, or there will be unreliable results.

4. Section 3.3.1, page 3-12, 1st paragraph.

Response: See Response to Comment 3.

5. Section 3.4.4, page 3-18, paragraphs 2, 3, and 4.

Response: This discussion is concerning QA/QC procedures and does not refer to sampling procedures.

6. Section 4.2, page 4-1, paragraph 2.

Response: The calculations presented assume that each sample will be analyzed before the next sample is taken. The sampling will be conducted in two phases. Based upon the results of the first phase, additional sampling may be warranted at selected locations in the second phase. This discussion will be expanded in the revised text to cover the EPA Observational/Streamline method and criterion for Phase II sampling.

The SVS Program involves collection and analysis of soil gas from 3 to 5 feet below the ground surface. Soil gas samples will be analyzed in a mobile laboratory unit with a gas chromatograph. The analytical results will be used to map the occurrence of VOCs in the soil gas and to assist in the identification of source areas.

DO VOCS READILY PARTITION OUT OF THE SATURATED ZONE. THUS WOULD BE A FUNCTION OF LIQUID PHASE DIFFUSIVITY.

The SVS is an effective way to map subsurface VOCs. VOCs readily partition out of the unsaturated and saturated zones and into the soil gas. The VOCs diffuse vertically and horizontally through the soil to the ground surface where they dissipate into the atmosphere. Typically, a concentration gradient develops between the source area and the ground surface. Thus, high VOC vapor levels at or near the ground surface may be indicative of a local source area.

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- Evaluation of analytical results and reporting.

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Section 2 of this Work Plan describes each of the locations to be surveyed and the criteria and rationale for the site sampling grid designs. Section 3 presents the SVS Program including field sampling procedures and analytical methods to be used to perform the SVS for each of the three sites. Section 4 presents the methods to be used to evaluate and report the data collected during

THIS LOCATION SHOULD BE SHOWN IN FIG. 1-2.

Trichloroethylene (TCE) is expected to be the primary contaminant at this site. A sample of water collected in May 1988 from monitoring well 3687 contained 221.8 milligrams per liter (mg/l), which represents 20 percent of the TCE solubility limit. This well is screened in the sandstone bedrock. The high concentration of TCE within 40 feet of IHSS No. 111.1 suggests the presence of residual free-phase TCE in the soils and aquifer underlying this burial trench. The conceptual model indicates that DNAPL has migrated downward through the unsaturated alluvium and sandstone leaving a zone of residual free-phase solvent. The solvent may have migrated downward through the saturated zone and come to rest in structural depressions on the claystone and migrated a short distance through the fractures in the claystone.

2.5 EAST TRENCHES AREA (IHSS No. 110)

IHSS No. 110 (Trench T-3) was used primarily for the disposal of sanitary wastewater treatment plant sludge. The sludge disposed in the trench typically consisted of concentrated organic matter found in sanitary wastewater treatment plant sludge. Uranium contamination may also be present as a result of contaminated, flattened drums that may have been disposed in the trench. The exact dates of operation of this trench are unknown. It is known, however, that disposal operations at Trench T-3 were conducted during the period of July 2, 1955 through August 14, 1968.

Site specific geologic, hydrogeologic, and contaminant type and distribution information for IHSS 110 is not currently available. The log of a shallow borehole (No. 2791) advanced as part of the Phase II RI 50 feet north of the east end of the trench was examined. The geology consisted of 12.9 feet of unsaturated, sandy gravel alluvium over a sandy/clayey siltstone bedrock. There is also a log available for a bedrock well (No. 12191) 15 feet south of the east side of the trench. The geology consisted of 15 feet of unsaturated, sandy gravel alluvium over silty sandstone to 27.5 feet where groundwater is first encountered. Next is a layer of sandstone between 27.5 feet and 35 feet underlain by clayey sandstone. The total depth of the well was 37 feet.

Table 3-1

Soil Vapor Survey Program
Data Quality Objectives

1. DATA USES/USERS:

Soil gas samples will be analyzed in an on-site mobile laboratory to provide qualitative data on VOCs in the unsaturated zone at each of five locations within OU2. Data will be used by the EG&G Project Manager to locate potential liquid VOC source areas. This data will be used to locate the vapor extraction wells.

2. DATA TYPES

- Systematic grab samples of soil gas along an established grid.

3. DATA QUALITY

a) Prioritized data uses:
   - Site characterization

b) Appropriate analytical level
   - Level II - mobile laboratory GC

c) Contaminants of concern
   - Carbon tetrachloride, TCE, and PCE

d) Required detection limit
   - 2 ppmV per contaminant of concern

TYPICAL ~~ORDOR~~ ODOR RECOGNITION TRESHOLD IS 5 PPMV THIS DETECTION LIMIT SEEMS KIND OF HIGH

4. DATA QUANTITY

- Initial grid on site, 406 samples (194 for IHSS 112, 104 for IHSS 113, 42 for IHSS 111.1, 42 for IHSS 110, and 24 IHSS 109).
- 20% additional samples to expand grid off-site or increase grid density on-site, depending on results from initial 20 samples.
- Approximately 10 deeper samples.

Table 3-1 (Continued)

Soil Vapor Survey Program
Data Quality Objectives

5. SAMPLING AND ANALYSIS APPROACH

A total of 485 samples of soil gas will be collected by inserting soil probes to a depth of 3 to 5 feet. A 125 milliliter sample will be collected in a glass bulb and analyzed for VOCs within 24 hours. Approximately 10 deeper samples will also be taken.

SINCE YOU HAVE A MOBILE LAB WHY NOT USE DIRECT INJECTION INTO THE GC. RATHER THAN A GLASS BULB.

6. PARCC PARAMETERS

a) Precision
- Field replicates ± 20% RPD
- Replicate analysis ± 10% RFD

b) Accuracy
- Use of calibration standards in laboratory provides accuracy.
- Analysis once per day of an independently prepared gas standard.

c) Representativeness
- Field duplicates 5% (within 2 feet of original sample location).
- Field replicates 10%.
- Replicate analysis 10%.

d) Completeness
- Laboratory completeness 95%
- Field completeness 90%

e) Comparability
- Soil gas VOC concentration data is qualitative and provide identification and relative concentration levels of VOCs in soil.

RPD - relative percent deviation

• HOW WILL THE SAMPLING BE EFFECTED AFTER A RAINFALL.

- Flow meter
- Gas-tight glass sampling syringes. ARE WE USING SYRINGES OR BULBS FOR GAS SAMPLING?

Sampling equipment will be made of materials such as Teflon, which will not compromise sample quality.

3.3.2 Mobile Laboratory Equipment

- Mobile laboratory van (air conditioned for protection of analytical equipment).
- Programmable gas chromatograph (GC), with photoionization detectors (PID), and electron capture detector (ECD).
- GC carrier gases.
- Laboratory oven.
- Generator with an exhaust tube to prevent exhaust gases from entering the mobile lab.
- Analytical standards.

Mobile laboratory equipment should be capable of attaining Level II analytical data quality. Pumps, tubing, and purge gases should be sufficiently inert to meet SVS program DQOs.

3.4 PROCEDURES

The following procedures are an example of those often used to conduct SVS programs. This discussion covers both field sampling procedures and analytical procedures. Procedures that will provide equivalent results may be substituted as long as the DQOs of the SVS are met (see Section 3.1). Several procedures or methods described in the following sections are considered essential elements of the SVS program and are so noted.

criteria for a field blank. If necessary, the analytical blank is repeated until this level is achieved.

- Ten percent of the soil gas samples shall be analyzed by duplicate injection. The relative percent difference (RFD) for all detected analytes is calculated and documented. The RPD of the two most concentrated species for duplicate injections must be less than 20 percent or a third injection is required. Soil gas samples which require dilution may require a fourth run to check reproducibility. The results from the third injection (or fourth in the case of a diluted sample) determine subsequent action as follows. If the data from the final injection results in RPDs of less than 50 percent (for the two most concentrated species), sample analysis may continue. However, it is imperative that associated data points from all samples analyzed since the last duplicate (or daily QC check if this is the first duplicate of the day) are flagged to note this excessive variability. If the RPDs using the third injection are greater than 50 percent for either of the two most concentrated species, immediate corrective action is required (i.e., stop sample analysis, locate source of problem, conduct system maintenance as needed). A mid-level gas standard must then be analyzed as described below under "QC check sample."

DOES THIS MEAN THAT DATA FROM EACH SAMPLE SITE MUST BE ANALYZED BEFORE PROCEEDING TO THE NEXT ONE.

- A GC system blank of UHP air shall be injected following samples which have levels above the calibrated range. The system blank shall be repeated until levels fall below 10 ppbv.

- A soil gas sample which contains a calibrated compund at a concentration above the calibrated range shall be diluted and rerun to bring it within the calibrated range.

- A QC check sample which shall be a standard in the middle of the calibrated range will be the last run of the day to determine drift on the instrument. Recoveries will be calculated for each compound and recorded on the daily report sheet. If recoveries are not within 70 to 130 percent of the true value for a compound, then the data will be flagged for that compound.

SECTION 4

DATA REPORTING AND ANALYSIS

4.1 DATA EVALUATION IN THE FIELD

The use of the mobile laboratory will allow collection of real-time analytical results (i.e., within 1 hour after the sample is taken). The Phase I grid sampling locations are based upon 15 foot intervals. If the analytical data generated during the Phase I soil vapor survey and prescreening of purged discharges indicates the presence of high levels of contaminants in certain locations, this information will be used to locate additional Phase II sampling points to better define the configurations of the contaminant source areas. Deeper samples may be taken, if the real-time analytical data indicates that no concentrations of VOCs are present, but it is suspected that there may be a residual pool of DNAPLs at the bedrock contact. This is most likely to occur at Mound where the saturated thickness of the aquifer is small or even seasonally dry.

4.2 DATA REPORTING REQUIREMENTS

The final project report will include each of the following elements for the SVS conducted at each site:

- Soil vapor VOC concentration and depth data.
- Quality Assurance/Quality Control results.
- Maps of sample locations.
- VOC isoconcentration maps.
- Discussion and data interpretation.
- Recommendations for location of the Pilot VES injection and extraction wells at each site.

1 HOUR/SAMPLE × 485 SAMPLES × $\frac{1 \text{ DAY}}{8 \text{ HOURS}}$ = 60 DAYS = 12 WEEKS

Responses to Comments by:
Brook Wilson

NOTE TO THE READER:

The comments on the Soil Vapor Survey Work Plan that were provided by Brook Wilson were made directly into a copy of the draft document. Responses to each of these comments are included in this section. To assist the reader, the appropriate pages of the original document are also included after the responses.

Commenter: Brook Wilson

Note: Handwritten comments were made directly in to a copy of the draft document. Responses to each of these comments are listed below.

1. Page 2-2 Comment in margin, Boring log for Boring 7391 has been reinterpreted by ASI.

Response: Our concern is with the sampling results, which have not changed, not in providing a detailed description of the site geology/hydrogeology.

2. Page 2-3 Text changes.

Response: Editorial changes will be made to page 2-3 as appropriate to clarify the text.

3. Page 2-4 Text changes.

Response: Editorial changes will be made to page 2-4 as appropriate to clarify the text.

WESTON disagrees with the comment to discuss other modes of dispersion into clay. The objective of this section is to explain how the majority of the DNAPLS may have pooled at the bedrock surface or moved into adjoining fractures. Dispersion into clays will be a minor effect relative to pooling at the bedrock surface and not significant for this discussion in the SVS work plan.

4. Page 2-5 Text changes.

Response: Editorial changes will be made to page 2-5 as appropriate to clarify the text.

5. Page 3-1.

Response: This typo will be corrected.

6. Page 3-4.

Response: This typo will be corrected.

structural depressions on the claystone bedrock surface. The DNAPL may also infiltrate bedrock fractures. Results of ground-water monitoring were inconclusive with respect to the presence of dissolved or free-phase chlorinated solvents in the bedrock.

2.2 903 PAD AREA (IHSS No. 109)

It is believed that IHSS No. 109 (Trench T-2) was used from approximately 1969 to 1971 for the disposal of nonradioactive liquid wastes. After radiation screening, solvents which were found to be nonradioactive were disposed into the trench. The solvents were disposed in small quantities and may have included PCE, TCE, carbon tetrachloride, paint thinner and small quantities of construction related chemicals.

The log of a boring (No. 7391) advanced as part of the Phase II RI 60 feet south of the trench was examined. The geology consists of unsaturated, clayey and sandy gravel over claystone bedrock which was encountered at 8.1 feet. Phase II RI analytical data is currently not available, however, a review of soil chemistry data presented in the Phase I RI (Rockwell, 1987) revealed the presence of 16 mg/kg of TCE in soils directly adjacent to Trench T-2. In addition, a TCE isoconcentration contour map presented in the IRAP (EG&G, 1992) shows a dissolved TCE groundwater plume apparently originating in the area around this trench. The presence of soil and ground water contamination in this area coupled with a history of solvent disposal suggests Trench T-2 as a source area for TCE contamination in this portion of the 903 Pad Area.

2.3 MOUND AREA (IHSS No. 113)

IHSS No. 113 was used to store an estimated 1,405 drums containing primarily depleted uranium and beryllium contaminated lathe coolant (a mixture of hydraulic oil and carbon tetrachloride). Some drums were reported to contain PCE. Ground-water samples collected downgradient of the Mound Area contained PCE, indicating that leakage from these drums may have occurred. Soil contamination at the Mound Area (IHSS No. 113) is expected to be limited to PCE and carbon tetrachloride.

must be more definite e.g. "is composed of" unsaturated

Results from drilling of exploratory boreholes and ground-water monitoring near the test site were used to construct a conceptual model of the site hydrogeology and contaminant type and distribution. This model is presented in Section 4.4.1.2 of the subsurface IM/IRAP/EA (EG&G, 1992). This model ~~indicates that~~ sand and gravel alluvium that extends to approximately 10 feet below ground surface and overlies claystone bedrock that may contain isolated or interconnected fractures. The alluvium is expected to be dry but may contain a small amount of seasonal ground water perched on the underlying claystone bedrock. Results of ground-water quality analyses of wells adjacent to IHSS No. 113 indicate that PCE comprises the majority of the VOC contamination in this area with lesser amounts of carbon tetrachloride present. The conceptual model suggests that free-phase PCE released at IHSS No. 113 infiltrated the alluvium and may have ~~formed a pool~~ reached the on claystone bedrock. The alluvium may also contain residual DNAPL.

The bedrock claystone ~~with~~ may have accumulated the DNAPL on top of bed, as a liquid or may have "wicked" the DNAPL into the bedrock.

2.4 EAST TRENCHES AREA (IHSS No. 111.1)

The East Trenches Area consists of nine burial trenches and two spray irrigation areas. Trench T-4 is designated IHSS No. 111.1. The trenches were used from 1954 to 1968 for disposal of depleted uranium; flattened, depleted uranium- and plutonium-contaminated drums; and sanitary sewage sludge. The wastes have not been disturbed since their burial.

No subsurface information is available directly beneath IHSS No. 111.1. Data from two monitoring wells installed approximately 40 feet north of the trench (well Nos. 3587 and 3687) (EG&G, 1992) were used to construct a conceptual model of the site hydrology and contaminant type and distribution. This model is presented in Section 4.5.1.2 of the subsurface IM/IRAP/EA (EG&G, 1992). The model indicates that sand and gravel alluvium extends to approximately 10 feet below ground surface and overlies fine- to medium-grained sandstone which extends to at least 75 feet below ground surface. The sandstone is underlain by claystone that may contain isolated or interconnected fractures. Unconfined ground water may be encountered at about 35 feet below ground surface in the sandstone.

Trichloroethylene (TCE) is expected to be the primary contaminant at this site. A sample of water collected in May 1988 from monitoring well 3687 contained 221.8 milligrams per liter (mg/l), which represents 20 percent of the TCE solubility limit. This well is screened in the sandstone bedrock. The high concentration of TCE within 40 feet of IHSS No. 111.1 suggests the presence of residual free-phase TCE in the soils and aquifer underlying this burial trench. The conceptual model indicates that DNAPL has migrated downward through the unsaturated alluvium and sandstone leaving a zone of residual free-phase solvent. The solvent may have migrated downward through the saturated zone and come to rest in structural depressions on the claystone and migrated a short distance through the fractures in the claystone.

Note other modes of dispersion into clays

2.5 EAST TRENCHES AREA (IHSS No. 110)

IHSS No. 110 (Trench T-3) was used primarily for the disposal of sanitary wastewater treatment plant sludge. The sludge disposed in the trench typically consisted of concentrated organic matter found in sanitary wastewater treatment plant sludge. Uranium contamination may also be present as a result of contaminated, flattened drums that may have been disposed in the trench. The exact dates of operation of this trench are unknown. It is known, however, that disposal operations at Trench T-3 were conducted during the period of July 2, 1955 through August 14, 1968.

Site specific geologic, hydrogeologic, and contaminant type and distribution information for IHSS 110 is not currently available. The log of a shallow borehole (No. 2791) advanced as part of the Phase II RI 50 feet north of the east end of the trench was examined. The geology consisted of 12.9 feet of unsaturated, sandy gravel alluvium over a sandy/clayey siltstone bedrock. There is also a log available for a bedrock well (No. 12191) 15 feet south of the east side of the trench. The geology consisted of 15 feet of unsaturated, sandy gravel alluvium over silty sandstone to 27.5 feet where groundwater is first encountered. Next is a layer of sandstone between 27.5 feet and 35 feet underlain by clayey sandstone. The total depth of the well was 37 feet.

Preliminary chemical data on soil samples collected as part of the Phase II RI revealed the presence of several chlorinated solvents. A soil sample collected at 3 feet below ground during the advancement of a boring (No. 10191) through the west end of Trench T-3 contained PCE at 1,300 mg/kg and lesser amounts of TCE, carbon tetrachloride and chloroform. Contaminant concentrations were found to decrease rapidly with depth in this boring. The high concentration of PCE in the soil suggests that DNAPL has migrated downward through the unsaturated alluvium and sandstone leaving some residual in this material.

Note That to date DNAPLS have not been observed in claystone or in alluvium.

SECTION 3
SOIL VAPOR SURVEY PROGRAM

This section presents the technical elements of the SVS program. These elements include Date Quality Objectives (DQOs), development of sampling locations for the 903 Pad Area (IHSS No. 112 and IHSS No. 109), Mound Area (IHSS No. 113), and East Trenches Area (IHSS No. 111.1 and IHSS No. 110) The field sampling procedures, on-site laboratory analysis, and a list of suggested and required equipment are presented, as well as decontamination procedures and requirements for management of investigation derived wastes.

3.1 DATA QUALITY OBJECTIVES

The project DQOs have been developed per EPA guidance, and include the following six data quality elements:

- Data uses/users.
- Data types.
- Data quality.
- Data quantity.
- Sampling and analysis approach.
- PARCC parameters (precision, accuracy, representativeness, completeness, and comparability).

The project-specific requirements for each of the data quality elements listed above are presented in Table 3-1.

3.2 SAMPLING GRIDS

The first phase of the SVS program involves locating soil vapor sampling points at the IHSSs as specified by the baseline sampling grids. The sampling grids are based on a 15 foot sampling

interval (Figures 3-1 to 3-5). A typical SVS sampling interval is 25 to 50 feet depending upon site geology (Devitt et al., 1987; Chambers and Hennier, 1991; Joyner and Thomsen, 1991; Nielsen, 1991). However, since the suspected contaminant sources are known and the purpose of the SVS is to optimize the location of soil vapor extraction wells, a smaller interval has been chosen. The grid points are placed in staggered rows to provide a triangular grid pattern, which has been demonstrated through statistical analysis to provide more complete coverage.

In the second phase of the SVS program, sampling intervals will be reduced at zones with highest concentrations by the use of additional sampling points to further define potentgridial contaminant source areas. Depending upon the source configuration, deeper samples may be required (at the direction of EG&G personnel) in certain locations. For example, the surface soils at the Mound Area IHSS No. 113 have been disturbed. There is evidence of a release due to high concentrations of dissolved contaminants found in a nearby well (No. 0174) (EG&G, 1992). A deeper soil gas sample taken at the same elevation as the screened interval (10 feet below ground) might detect contaminants not present in the surface soils.

An estimated total of 406 sampling points will be required to obtain a 15 foot grid spacing for the Phase I baseline sampling at the five sites. It is estimated that 42 points will be required for IHSS No. 111.1; 104 points for IHSS No. 113; 194 points for IHSS No. 112; 24 points for IHSS No 109; and 42 points for IHSS No. 110. For Phase II sampling, a number of sampling points equal to 20% of the Phase I sampling points will be made available to better characterize potential contaminant source areas. It is estimated that 10 deep sampling points (up to 10 feet in depth) may be required if shallow samples contain no contaminants.

3.2.1 903 Pad Area (IHSS No. 112)

The 903 Pad covers an area of approximately 395 feet by 370 feet (Figure 3-1). Aerial photographs of the 903 Pad taken on 29 April 1967, 10 April 1968, and 24 May 1969 (DOE, 1992a) indicate areas of soil staining. The SVS will concentrate on these stained areas (Figure 3-1) because they are anticipated to produce higher levels of soil gas VOCs as compared to unstained areas. A grid consisting of 194 sample points has been designed to cover these